

CLAIMS

1. A process of production of a high strength galvannealed steel sheet comprising continuously hot-dip galvanizing a high strength steel sheet having a content of Si of 0.4 to 2.0 wt% during which making the atmosphere of the reducing zone an atmosphere containing H<sub>2</sub> to 1 to 60 wt% and comprised of the balance of N<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub>, CO<sub>2</sub>, CO, and unavoidable impurities, controlling, in the atmosphere, the log(PCO<sub>2</sub>/PH<sub>2</sub>) of the carbon dioxide partial pressure and hydrogen partial pressure to 5  
log(PCO<sub>2</sub>/PH<sub>2</sub>)≤-0.5, the log(PCO<sub>2</sub>/PH<sub>2</sub>) of the water partial pressure and hydrogen partial pressure to  
log(PH<sub>2</sub>O/PH<sub>2</sub>)≤-0.5, and the log(P<sub>T</sub>/PH<sub>2</sub>) of the total 10  
partial pressure P<sub>T</sub> of the carbon dioxide partial pressure PCO<sub>2</sub> and water partial pressure PH<sub>2</sub>O and the  
hydrogen partial pressure to -3≤log(P<sub>T</sub>/PH<sub>2</sub>)≤-0.5,  
performing the annealing in the reducing zone in a 15  
ferrite-austenite two-phase temperature region at 720°C to 880°C, then cooling by a plating bath and performing  
the molten zinc plating so as to form a hot-dip  
galvanizing layer on the surface of the cold rolled steel  
sheet, then heating for alloying the steel sheet on which  
the hot-dip galvanizing layer is formed at 460 to 550°C,  
it is possible to produce a high strength galvannealed  
steel sheet. 20  
25

2. A process of production of a high strength galvannealed steel sheet as set forth in claim 1,  
characterized by performing the hot-dip galvanizing in a  
hot-dip galvanizing bath of a composition comprised of an  
effective Al concentration in the bath of at least 0.07  
wt% and the balance of Zn and unavoidable impurities and  
performing the alloying at a temperature (°C) satisfying  
30  
 $450 \leq T \leq 410 \times \exp(2 \times [Al\%])$   
where, [Al%]: effective Al concentration (wt%)  
35  
in the hot-dip galvanizing bath

3. A process of production of a high strength

galvannealed steel sheet as set forth in claim 1 or 2 superior in bondability, characterized by being performed at an effective Al concentration (wt%) in the bath satisfying the effective Al concentration in the bath of:

5            $[Al\%] \leq 0.092 - 0.001 \times [Si\%]^2$

where, [Si%]: Si content in steel sheet (wt%)

4. A manufacturing equipment of hot-dip galvanized steel sheet comprising providing a hot-dip galvanizing bath and continuously plating a steel sheet by molten zinc, said system for production of a hot-dip galvanized steel sheet for working the process of production of a high strength galvannealed steel sheet described in claim 1 characterized by making the annealing furnace an all radiant tube type annealing furnace and providing an apparatus for introducing into the annealing furnace a gas containing CO<sub>2</sub> in an amount of 1 to 100 wt% and comprised of the balance of N<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub>, CO, and unavoidable impurities.

20           5. A system for production of a hot-dip galvanized steel sheet comprising providing a hot-dip galvanizing bath and continuously plating a steel sheet by molten zinc, said system for production of a hot-dip galvanized steel sheet for working the process of production of a high strength galvannealed steel sheet described in claim 1 characterized by making the annealing furnace an all radiant tube type annealing furnace and providing an apparatus for burning CO or a hydrocarbon in the annealing furnace and producing a gas containing CO<sub>2</sub> in an amount of 1 to 100 wt% and comprised of the balance of N<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub>, CO, and unavoidable impurities.